IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A solid-state image pickup apparatus which incorporates a semiconductor substrate having an image pickup region including unit pixels disposed in a two-dimensional configuration and signal scanning sections for reading signals from the unit pixels in the image pickup region, the solid-state image pickup apparatus comprising:

a photoelectric conversion region having a first-conduction-type signal accumulating section formed at a position apart from a top surface ~~an interface~~ of the semiconductor substrate in a direction of a depth of the semiconductor substrate for a predetermined distance and arranged to accumulate signal charges obtained from photoelectric conversion;

a gate electrode of a first-conduction-type MOS field effect transistor formed adjacent to the photoelectric conversion region and arranged to discharge a signal charge from the first-conduction-type signal accumulating section;

a first-conduction-type detecting node section serving as a drain region for receiving the signal charges from the photoelectric conversion region via the gate electrode; and

a barrier layer formed at least close to a lower part of the first-conduction-type detecting node section of the MOS field effect transistor, wherein

at least a part of the first-conduction-type signal accumulating section in a direction of a channel thereof extends to overlap the gate electrode in a direction in which signals are discharged,

modulation of the potential of the gate electrode is used to discharge signals from the first-conduction-type signal accumulating section through the channel of the MOS field effect transistor, and

the first-conduction-type detecting node section is not located below the gate

electrode but at <u>a second side of the gate electrode opposite to a first side of the gate electrode</u>

<u>formed adjacent to the photoelectric conversion region</u> an opposite side of the gate electrode.

Claim 2 (Currently Amended): A solid-state image pickup apparatus according to

claim 1, further comprising a diffusion-layer region which is formed <u>adjacent to the top</u>

<u>surface</u> in the interface of the semiconductor substrate above the first-conduction-type signal

accumulating section, which has a second-conduction-type opposite to the conduction type of

the first-conduction-type signal accumulating section and which contains impurities at a

concentration which is higher than the concentration of impurities contained in the channel

region of the first-conduction-type MOS field effect transistor.

Claim 3 (Withdrawn): A solid-state image pickup apparatus according to claim 1,

wherein a length of a portion of the first-conduction-type signal accumulating section

extending to overlap the gate electrode in the direction in which signals are discharged is

shorter than 1/2 of a length of the gate electrode of the first-conduction-type MOS field effect

transistor.

Claim 4 (Withdrawn): A solid-state image pickup apparatus according to claim 2,

wherein a length of a portion of the first-conduction-type signal accumulating section

extending to overlap the gate electrode in the direction in which signals are discharged is

shorter than 1/2 of a length of the gate electrode of the first-conduction-type MOS field effect

transistor.

Claim 5 (Currently Amended): A solid-state image pickup apparatus according to claim 2, wherein a length of a portion of the first-conduction-type signal accumulating section extending to overlap the gate electrode in the direction in which signals are discharged is longer than 1/2 of a depth of a junction of the diffusion-layer region from the top surface ~~interface~~ of the semiconductor substrate.

Claim 6 (Currently Amended): A solid-state image pickup apparatus according to claim 1, wherein the first-conduction-type signal accumulating section has a first region formed below the gate electrode and a second region formed at a position except for a position below the gate electrode, and a depth of the first-conduction-type signal accumulating section in the first region from the top surface ~~interface~~ of the semiconductor substrate is smaller than a depth of the first-conduction-type signal accumulating section in the second region.

Claim 7 (Currently Amended): A solid-state image pickup apparatus according to claim 2, wherein the first-conduction-type signal accumulating section has a first region formed below the gate electrode and a second region formed at a position except for a position below the gate electrode, and a depth of the first-conduction-type signal accumulating section in the first region from the top surface ~~interface~~ of the substrate is smaller than a depth of the first-conduction-type signal accumulating section in the second region.

Claim 8 (Currently Amended): A solid-state image pickup apparatus according to claim 3, wherein the first-conduction-type signal accumulating section has a first region formed below the gate electrode and a second region formed at a portion except for a position

below the gate electrode, and a depth of the first-conduction-type signal accumulating section in the first region from the top surface ~~interface~~ of the substrate is smaller than a depth of the first-conduction-type signal accumulating section in the second region.

Claim 9 (Currently Amended): A solid-state image pickup apparatus according to claim 4, wherein the first-conduction-type signal accumulating section has a first region formed below the gate electrode and a second region formed at a position except for a position below the gate electrode, and a depth of the first-conduction-type signal accumulating section in the first region from the top surface ~~interface~~ of the substrate is smaller than a depth of the first-conduction-type signal accumulating section in the second region.

Claim 10 (Currently Amended): A solid-state image pickup apparatus according to claim 5, wherein the first-conduction-type signal accumulating section has a first region formed below the gate electrode and a second region formed at a position except for a position below the gate electrode, and a depth of the first-conduction-type signal accumulating section in the first region from the top surface ~~interface~~ of the substrate is smaller than a depth of the first-conduction-type signal accumulating section in the second region.

Claim 11 (Withdrawn): A solid-state image pickup apparatus incorporating a first-conduction-type well region formed on a semiconductor substrate, a photodiode section formed on the first-conduction-type well region and having a second-conduction-type region, a first-conduction-type surface layer formed on the second-conduction-type region of the photodiode section, a second-conduction-type drain region formed in the

first-conduction-type well region adjacent to the second-conduction-type region of the photodiode section, and a gate section of a reading transistor formed above the first-conduction-type well region at a position between the second-conduction-type drain region and the second-conduction-type region of the photodiode section, the solid-state image pickup apparatus comprising:

a first-conduction-type barrier well formed by an offset which extends from a deep portion in the second-conduction-type drain region toward the second-conduction-type region of the photodiode section, whose concentration is higher than a concentration of a first-conduction-type well layer, the first-conduction-type barrier well being formed at least at a lower part of the second-conduction-type drain region; and

a second-conduction-type and high-concentration channel formation layer located at a position more adjacent to a surface layer than a position of the second-conduction-type barrier well, and also provided toward an end of the gate section.

Claim 12 (Withdrawn): A solid-state image pickup apparatus according to claim 11, wherein the second-conduction-type and high-concentration channel formation layer is formed to extend over the second-conduction-type region of the photodiode section at a position between the first-conduction-type surface layer and a position below the gate section.

Claim 13 (Withdrawn): A solid-state image pickup apparatus according to claim 11, further comprising a second-conduction-type channel formation layer formed on the first-conduction-type barrier well at a position adjacent to both of the photodiode section and the second-conduction-type drain region.

Claim 14 (Withdrawn): A solid-state image pickup apparatus according to claim 11, wherein a first-conduction-type barrier well having a concentration higher than the concentration in the first-conduction-type well layer is formed in place of the first-conduction-type barrier well.

Claim 15 (Withdrawn): A solid-type image pickup apparatus incorporating a photodiode region, which has a shield layer for preventing surface recombination and which is formed into a surface shield structure, and a reading gate electrode for reading charges in the photodiode region, the solid-state image pickup apparatus comprising:

an impurity region formed at least between the reading gate electrode and the shield layer, having a depth which is different from a depth of the photodiode region;

a drain region to which a charge inside the photodiode region is transferred from the reading gate electrode; and

a barrier layer formed close to at least a lower part of the drain region, having a concentration higher than a concentration of a semiconductor substrate.

Claim 16 (Withdrawn): A solid-state image pickup apparatus according to claim 15, wherein the shield layer is formed apart from the reading gate electrode.

Claim 17 (Withdrawn): A solid-state image pickup apparatus according to claim 15, wherein the impurity region shares at least a part of the photodiode region and contains an end of the photodiode region.

Claim 18 (Withdrawn): A solid-state image pickup apparatus according to claim 15, wherein the impurity region has a part which reaches a lower portion of the reading gate electrode.

Claim 19 (Withdrawn): A solid-state image pickup apparatus according to claim 15, wherein the impurity region has a concentration higher than a concentration in the photodiode region.